

## Proposed Structure of M. Sc, Syllabus

### Semester-I

### M. Sc. (Chemistry)

Sr. No.	Course Code	Course Title	L	T/C/S	Credit
1	CHI 101	Inorganic Chem	4		4
2	CHO 102	Organic	4		4
3	CHP 103	Physical	4		4
4	CHA 104	Instrumental and chemical analysis	4		4
5	CHPR 105	Practicals + T/C/S	12	3	6 + 3
			28	3	25

Faculty Code: Science

Subject code:

Level code:

Name of program: M. Sc.

Subject: Chemistry

External Examination Time Duration: 03 hrs

Name of Exam	Semester	Paper No	Course group	Credit	Internal Marks	External Marks	Total Marks
M. Sc.	I	CHI 101	Core	04	30	70	100
		CHO 102	Core	04	30	70	100
		CHP 103	Core	04	30	70	100
		CHA 104	Core	04	30	70	100
		CHPR 105	Practical + T/C/S	06 + 3	60	140	200
			Total	25	180	420	600



**VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)**

**PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE 2018**

**PAPER-I (Inorganic Chemistry)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total Periods:**

**45**

**SEMESTER-I**

**UNIT-1: Symmetry and Group Theory In Chemistry and Its applications: 12 Periods**

Representation of Groups: Preparation of matrices and vectors matrix notations for geometrical transformations, orthogonality theorem and its consequences, reducible and irreducible representations and their relation, preparation of character table for  $C_{2v}$  and  $C_{3v}$  point groups, Application of group theory to- Transformation properties of atomic crystals.

**UNIT-2 :Quantum Mechanics: 11 Periods**

Discussion of solution of schrodinger equation to same model system e.g. the one dimensional harmonic oscillator, two particale rigid rotator. Ordinary angular momentum , generalized angular momentum, Eigen functions of aungular momentum, Eigen values of angular momentum, different types of operators and their uses, addition of angular momentum, spin, Russel-Saunders terms and coupling scheme, term separation energies of the  $p^n$  and  $d^n$  configuration, magnetic effect:spin orbit coupling and Zeeman effect (splitting).

**UNIT-3:Inorganic Reaction Mechanism: 11 Periods**

Labile ana inert complexes, factors responsible for lability and inertness of complexes.

Reactivity of metal complexes, ligand replacement reaction: classification of mechanism and energy profile of reaction. Inert and lable complexes, interpretation of liability and inertness of transition metal complexes on the basis of reaction rate, VBT and CFT.

Transition state or activated complex, substrate, attacking reagents electrophilic and nucleophilic, Nature of central atom. Kinetic application of CFT.

Kinetics of octahedral substitution, acid hydrolysis, factor affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favor of conjugate mechanism.

**UNIT-4: Metal Clusters: 11 Periods**

Introduction , Classification, Carbonyl clusters, Low nuclearity carbonyl clusters, High nuclearity carbonyl clusters, Electron conuting scheme for HNCCS, Wade's rules.

Halides type clusters: Dinuclear clusters, Trinuclear clusters, Tetranuclear clusters, Hexanuclear cluster.

Chevrel phases and Zintl Ions, Carboranes, Metalloboranes, Metallocarboranes, Higher boranes (Hexaborane-10, Decaborane-14) , Number and types of bonds present in higher boranes .



**Reference book:**

1. Quantum Chemistry by Ira N. Levine, Prentice-Hall of India Pvt. Ltd., New Delhi, 1994.
2. Introductory Quantum Chemistry (Third edition) by N. W. Hanna, Benjamin, Menlo Park, Calif, 1988.
3. Quantum Chemistry and Spectroscopy by M. S. Pathania, Vishal Publications, India, 1981.
4. Chemical applications of group theory by F. A. Cotton ( Second edition ), Wiley Eastern Limited, 1976  
New  
Delhi.
5. Group theory and its applications by P. K. Bhattacharya, Himalaya Publishing Hours, Mumbai, 1986.
6. Group theory and symmetry by L. R. Hall, McGraw Hill, New York, 1989.
7. 'Kinetic and Mechanism' by A. A. Frost and R. G. Pearson, Wiley, New York, 1953, 1961.
8. Mechanism of Inorganic Reactions by F. Basolo and R. G. Pearson, Second Edition, Wiley Eastern Limited, New Delhi, 1977.
9. Advanced Inorganic Chemistry by F. A. Cotton and R. G. Wilkinson, John Wiley & Sons, N. Y.
10. Principles of Inorganic Chemistry, by Puri. Sharma and Kalia, 33<sup>rd</sup> Edition, Vishal publishing Co. Jalandhar, Dehli, 2017.
11. Advanced Inorganic Chemistry by S.K. Agarwala and Keemtilal, Pragati Prakashan, Meerut.
12. Advanced Inorganic Chemistry, Volume-II by Gurdeep Raj, Krishna Prakashan Media Ltd., Meerut.
13. Inorganic Chemistry by Gary L. Miessler and Donald A. Tarr, Pearson Education  
International

**M.Sc.Sem. 1 (Inorganic Practicals)**

1. Inorganic Qualitative Analysis:  
(Six elements including ONE rare element)
2. Inorganic Preparation:
  - i. Hexa-amine nickel (II) chloride
  - ii. Mohr's salt (Ferrous Ammonium sulphate)
  - iii. Sodium trioxalato ferrate trihydrate
  - iv. Sodium cobaltinitrite
  - v. Tetra amine cupric silphate
  - vi. Reineek's salt (Ammonium tetrathiocyanate diamine Chromate)

**Reference Book:**

1. A textbook of practical inorganic chemistry – A.I. Vogel
2. Practical Chemistry by Dr.O.P.Pandey, D.N. Bajpai, Dr.S. Giri
3. Advance inorganic analysis by Agarwal, Keemti lal
4. Qualitative Inorganic analysis – Vogel
5. Inorganic practical by Chatwal and Anand



**VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)**

**PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE 2018**

**PAPER-II (Organic Chemistry)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total Periods: 45**

**SEMESTER-I**

**UNIT-I: REACTION MECHANISM & REACTIVE INTERMEDIATES 12 periods**

**Detailed study of organic reaction intermediates. Generation, structure, stability and reactions of –**

**Carbocations (Classical and non-classical):** Phenonium ion, norbornyl system, common carbocation rearrangements- Demjanov, Pinacole-Pinacolone, Rupe.

**Carbanions:** Mechanism of condensation involving enolates - Aldol, Claisen, Mannich, Dieckmann, Michael and Shapiro reactions.

**Carbenes:** Mechanism of Arndt-Eistert reaction, Reimer-Tiemann reaction and Bamford Steven's rearrangement reaction.

**Free Radicals:** Allylic halogenation (NBS), coupling of alkenes and arylation of aromatic compounds by diazonium salts. Sandmeyer reactions. Free radical rearrangements, Hunsdiecker reaction.

**Reference book:**

1. Carbenes, Benzynes and Nitrenes by Gilchrist, T. L. and Rees.
2. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
3. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
4. Organic Chemistry (3/e) by J. B. Hendrickson, Donald J. Cram and George S. Hammond (McGraw-Hill Book Co. & Kogekusha Co. Ltd., 1970).
5. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
6. Advanced Organic Chemistry by Carey & Sundberg (3<sup>rd</sup> edition).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
8. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
9. Organic chemistry 2<sup>nd</sup> ed. Jonathan clayden, Nick greeves, Stuart Warren.
10. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).



## UNIT-II: PERICYCLIC REACTIONS

11 periods

**Introduction** - Definition, Characteristics and Classification

Molecular orbitals and symmetry properties of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl systems.

**Electrocyclic Reactions:** Woodward-Hoffman Correlation diagram and derivation of selection rules, Conrotatory and disrotatory motions, FMO and PMO approach for  $4n$  and  $(4n+2)$   $\pi$  electron system and allyl systems.

**Cycloaddition Reactions:** Antarafacial and suprafacial additions. FMO and PMO approach for  $4n$  and  $(4n+2)$   $\pi$  electron systems (No correlation diagram), Diels-Alder reaction, stereoselectivity, Effect of substituents.

**Sigmatropic rearrangements:** Suprafacial and antarafacial shifts involving H & C moieties, retention and inversion of configurations.

The Cope and Claisen rearrangements, Ene reaction, 1,3-dipolar cycloadditions.

Examples of electrocyclic, cycloaddition and sigmatropic rearrangements.

### Reference book:

1. March's Advanced Organic Chemistry Reactions, Mechanisms, And Structure 7<sup>th</sup> ed. 2013 Michael B. Smith. Wiley.
2. Mechanism And Theory In Organic Chemistry-2007 by Thomas H. Lowry, Kathleen S. Richardson, Forbes. Harper & Row, Publishers. New York, Hagerstown, San Francisco, London.
3. Advanced Organic Chemistry Part A: Structure and Mechanisms by Carey & Sundberg (5<sup>th</sup> edition), 2000, Springer.
4. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
5. Photochemistry And Pericyclic Reactions 3<sup>rd</sup> ed. by Jagdamba Singh 2010. New Age International Publishers Ltd. New Delhi.
6. Pericyclic Reactions A mechanistic and problem solving approach Sunil Kumar, Vinod Kumar, S.P. Singh Academic Press 2015

## UNIT-III; SUBSTITUTION AND ELIMINATION REACTIONS

11 periods

**A: Aliphatic Nucleophilic Substitution:** The  $SN^1$ ,  $SN^2$ ,  $SN^i$  mechanisms. Reactions of Allylic halides, neighbouring group participation by  $-OH$ ,  $-NH_2$ ,  $-COO^-$ ,  $-RS$ ,  $-halogen$ , aromatic ring.

**B: Aromatic Nucleophilic Substitution:** The  $SN^2$ ,  $SN^1$  and benzyne mechanisms, Reactivity - effect of substrate structure, leaving group and attaching nucleophile, The Von Richter rearrangement.

**C: Elimination reaction:** Hoffmann and Zaitsev's rule of elimination, E1, E2 and E1cB Reaction mechanism and orientation.



**Reference book:**

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
3. Organic Chemistry (3/e) by J. B. Hendrickson, Donald J. Crem and George S. Rammond (McGraw-Hill Book Co. &Kogekusha Co. Ltd., 1970).
4. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
5. Advanced Organic Chemistry by Carey &Sundberg (3<sup>rd</sup> edition).
6. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
7. Physical organic chemistry by Jack Hyne
8. Reaction mechanism by Jagdambasingh.
9. organic chemistry - Reaction mechanism, by P.S. Kalsi, New age international publishers.

**UNIT-IV: Stereochemistry****11 periods**

**A.** Stereo chemical principles; Enantiomeric relationships; Distereomeric relationship; R-S and E-Z nomenclature; Dynamic stereochemistry; Chiral-Prochiral relationships; Stereo selective and Stereo specific reactions; Racemates and racemic modification, Resolution of racemic modification, Optical activity in the absence of chiral carbons biphenyl, allenes, spiranes.

**B.** Confirmational Analysis: Interconversion of Fischer, Newman and Sawhorse projections. Newer method of asymmetric synthesis (including enzymatic and catalytic nexus), enantio and diastereo selective synthesis. Simple acyclic and cyclic (chair and boat cyclohexanes, Decalins, Perhydrophenanthrene)systems.Effects of conformation on reactivity in acyclic compounds and substituted cyclohexanes.

**Reference book:**

1. Advanced Organic Chemistry: Part A: Structure and Mechanisms; By Francis A. Carey, Richard J. Sundberg, fifth edition, Published by Springer.
2. Advanced Organic Chemistry: Part B: Reaction and Synthesis; By Francis A. Carey, Richard J. Sundberg, fifth edition, Published by Springer.
3. Stereochemistry of Carbon Compounds; By Ernest L. Eliel, Published by Tata McGraw-Hill Publishing Company Ltd.
4. Basic organic stereochemistry; By Ernest Ludwig Eliel, Samuel H. Wilen, Michael P. Doyle, Published by Wiley-Interscience.
5. Introduction to Stereochemistry; By Kurt Martin Mislow, Dover Publication INC.
6. Stereochemistry of Organic Compounds: Principles and Applications; By D. Nasipuri, New Age International (P) Ltd. Publisher.
7. Stereochemistry Conformation and Mechanism; By P.S. Kalsi, New Age International (P) Ltd. Publisher.
8. Basic Stereochemistry of Organic; By SubrataSen Gupta, First edition, Published by Oxford University Press.



**VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)**

**PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE 2018**

**PAPER-III (PHYSICAL CHEMISTRY)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total Periods: 45**

**SEMESTER-I**

**UNIT-I: CHEMICAL KINETICS**

**12 Periods**

Theories of Unimolecular gas reactions: Lindemann theory, Kinetics of some complex reactions (i) Reversible reactions (only first order opposed by first order) (ii) Consecutive reactions ( $A \rightarrow B \rightarrow C$ ); Steady state treatment or approximation, Enzyme catalysed reactions, Kinetics of general Chain reaction, Kinetics of photochemical reactions ( $H_2-Cl_2$  and  $H_2-Br_2$ ), Kinetics, Mechanism, determination of activation energy and chain length of some organic decomposition (i) decomposition of ethane (ii) decomposition of acetaldehyde, Effect of Ionic strength on rates of ionic reactions (Primary and secondary salt effect)  
Numerical.

**UNIT- II: THERMODYNAMICS**

**11 Periods**

Introduction to Laws of thermodynamics, state and path functions and their applications, thermodynamic description of various types of processes, Maxwell's relations, Partial molar quantities, Calculation of partial molar quantities, determination of partial molar volume and partial molar enthalpy, Ideal and non-ideal liquid mixtures, Thermodynamic functions of mixing of non-ideal solutions (i) free energy of mixing (ii) entropy of mixing (iii) volume of mixing and (iv) enthalpy of mixing, Excess functions ( $\mu^E$ ,  $G^E$ ,  $S^E$ ,  $H^E$  and  $V^E$ ) for non ideal solutions and expression for excess thermodynamic functions.  
Numerical

**UNIT –III STATISTICAL THERMODYNAMICS**

**11 Periods**

Basics of Statistical thermodynamics (Assembly, Canonical ensemble, occupation number, statistical weight factor, probability), Thermodynamic probability, Probability and entropy, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Lagrange's methods of multipliers, Partition function, Thermodynamic properties in term of partition functions (i) Internal energy (ii) Heat Capacity (iii) Third law of thermodynamics (iv) Helmholtz free energy (v) Enthalpy (vi) Gibb's free energy (vii) Chemical potential (viii) Equilibrium constant Molecular partition functions for an ideal gas, Derivation for Translational, Rotational and Vibrational partition functions  
Numerical.

**UNIT-IV: POLYMER CHEMISTRY**

**11 Periods**

Types of polymers, Stereochemistry of polymers, Kinetics of polymerization (Addition and Condensation), Thermodynamics of polymerization, Phase techniques of polymerization (Bulk, solution, suspension and emulsion), Number & Mass average Molecular mass, Polydispersity Index (P.D.I) Molecular mass determination by Viscometry and Osmometry, Thermal transitions in polymer: glass transition temperature and its significance,  
Numerical



## Reference Book:

1. **Physical Chemistry, Atkins, P.W., W.H. Freeman (2017) 10th edition**
2. **Thermodynamics for chemist Samuel Glasstone, East-West Press Pvt. Ltd. (2008)**
3. **Principles of Physical Chemistry Puri B.R., Sharma L.R. and Pathania, M.S., Vishal Publishing Co. 41th ed. (Kinetics of some complex reactions (i) Reversible reactions (only first order opposed by first order), Consecutive reactions page no. 700-704) Kinetics of general Chain reaction page no. 706-708 Kinetics of photochemical reactions ( $H_2-Br_2$ ) page no. 351-352 Maxwell's relations page no. 565 Number & Mass average Molecular mass, Polydispersity Index (P.D.I) Molecular mass determination by Viscometry and Osmometry page no. 1036-1042 Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Lagrange's methods of multipliers, page no. 629-635 Molecular partition function for an ideal gas, Derivation for Translational, Rotational And Vibrational partition functions page no. 636-641**
4. **Chemical Kinetics Laidler K.J. TATA McGRW-HILL PUBLISHING COMPANY LTD., (Theories of unimolecular gas reactions: Lindemann theory Page No. 143-147) Steady state treatment or approximation page no. 327-328 Enzyme catalysed reactions page no. 474-477 Kinetics of photochemical reactions ( $H_2-Cl_2$  and  $H_2-Br_2$ ) page no. 360-364, 327-328, 358-359 Kinetics, Mechanism and determination of activation energy and chain length of some organic decomposition (i) decomposition of ethane (ii) decomposition of acetaldehyde page no. 386-390**
5. **Principles of Chemical Kinetics, James E. House, Elsevier Publication**
6. **Kinetics and Mechanism of Chemical Transformations, Rajaraman, J. and Kuriacose, J., McMillan (2008).**
7. **Kinetics of chemical reactions S.K. Jain, Vishal Publications**  
Mechanism and determination of activation energy and chain length of some organic decomposition (i) decomposition of ethane (ii) decomposition of acetaldehyde page no. 141-143, 144-145 Effect of Ionic strength on rates of ionic reactions (Primary and Secondary Salt Effect) page no. 160-162 Kinetics of polymerization (Addition and Condensation) page no. 192-195
8. **A Text Book of Physical chemistry K.L. Kapoor Vol-5 Macmillan India Ltd. 2007**  
Effect of Ionic strength on rates of ionic reactions (Primary and Secondary Salt Effect) page no. 164-167
9. **An Introduction to Chemical Thermodynamics R P Rastogi and R R Mishra VIKASH PUBLISHING HOUSE PVT LTD. 6<sup>th</sup> edition** Introduction to Laws of thermodynamics, state and path functions and their applications, thermodynamic description of various types of processes page no. 1-15, 42-47 Maxwell's relations page no. 254-258 Partial molar quantities (Partial molar volume, Internal energy, enthalpy, entropy, Gibbs free energy and Work function) page no. 318-325 Thermodynamics functions of mixing of non-ideal solutions (i) free energy of mixing (ii) entropy of mixing (iii) volume of mixing and (iv) enthalpy of mixing page no. 396-397 Calculation of partial molar quantities determination of partial molar volume and partial molar enthalpy page no. 402-413





Excess functions( $\mu^E$ ,  $G^E$ ,  $S^E$ ,  $H^E$  and  $V^E$ ) for non ideal solutions and expression for excess thermodynamic function. Page no. 397-398

(Assembly, Canonical ensemble, occupation number, statistical weight factor, probability page no. 269-273 Thermodynamic probability, Probability and entropy page no. 274-278 Partition function page no. 284 Thermodynamic properties in term of partition functions (i) Internal energy (ii) Heat Capacity (iii) Third law of thermodynamics (iv) Helmholtz free energy (v) Enthalpy (vi) Gibb's free energy (vii) Chemical potential (viii) Equilibrium constant page no. 286- 291

**10. Advanced Physical Chemistry D.N.Bajpai S.CHAND & COMPANY LTD. 2<sup>nd</sup> edition**

Effect of Ionic strength on rates of ionic reactions (Primary and secondary salt effect) Page no. 508-512 Partition function page no. 275-276 Derivation for Translational, Rotational and Vibrational partition functions page no. 278-282.

**11. Polymer science by V.R.Gowariker. WILEY EASTERN LTD.**

Types of polymers (12). Stereochemistry of polymers (46). Kinetics of polymerisation (105). Phase techniques (71). Number and mass average molecular mass, PDI (90). Molecular mass determination by viscometry and osmometry (404, 392). Glass transition temperature (150)

## SEMESTER -I

### GROUP-C PHYSICAL PRACTICAL ( Any Six)

1. Determine the dissociation constants of a given dibasic acid pH-metrically.
2. Determine the amount of ferrous sulphate / ferrous ammonium sulphate in given flask potentiometrically using ceric salt solution.
3. Verification of Onsager's equation and determination of equivalent conductance at infinite dilution of strong electrolytes
4. Determine the CMC of a surfactant by conductivity measurements.
5. Calculate the molar absorptivity of each of the given two solutions (A) and (B) and also find out concentration of supplied unknown solution colorimetrically.
6. Investigation the reaction between  $K_2S_2O_8$  and KI at two different temperatures and calculate the energy of activation for the reaction.
7. To study the phase diagram of a three component system Water – acetic acid – chloroform.
8. Determination of CMC and area per molecule of a surfactant by surface tension measurement.
9. Determine the molecular weight of a given polymer from viscosity measurement.

**Note :** For instrumental analysis, solution should be prepared by the candidate.



**VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)**

**PROPOSED SYLLABUS TO EFFECTIVE FROM JUNE-2018**

**PAPER-IV (Instrumental and chemical analysis)**

**Max. Marks: 100(External –70 + Internal – 30 )**

**Total Periods: 45**

**SEMESTER-I**

**UNIT-I: UV-Visible Spectrophotometry**

**12 Periods**

Types of electronic transition, auxochrome, chromophore, Bathochromic effect, Hypso chromic effect, Hyper chromic effect, Hypo chromic effect, Factor affecting  $\lambda_{max}$  like resonance, hyper conjugation, hydrogen bonding, steric effect, Woodward's rules for  $\alpha,\beta$ -unsaturated ketones, Diene systems, aromatic system, Effect of solvent on absorption bands, law of absorption with derivation, Elementary idea of double beam automatic recording, Spectrophotometer, Application.

**UNIT-II: CHROMATOGRAPHY**

**11 Periods**

**Thin-Layer Chromatography:** Selection of stationary and mobile phase, Detection techniques –Elementary idea of HPTLC

**Gas Chromatography:** Selection of mobile phase – Selection of stationary phase in GLC and GSC – Detectors: FID (with modifications), TCD and ECD, Their comparison, Packed column, WCOT, SCOT (advantages and disadvantages) – Temperature programming – Derivatisation in GC – Quantitative Analysis.

**UNIT-III: CHEMICAL MATHEMATICS**

**11 Periods**

Errors in Chemical analysis, classification of errors, nature and origin of errors, Propagation of error, Accuracy and precision, Average deviation and standard deviation and its physical significance, Normal Distribution curve and its properties. Confidence limit and probability, Statistical treatment for error analysis, student 't' test, rejection criteria and Q-test, method of least square

**UNIT-IV: THERMAL METHODS OF ANALYSIS**

**11 Periods**

**(A) THERMOGRAVIMETRY:**

Thermogravimetry, Instruments for TGA- thermobalance and furnace, Calibration of temperature scale, Factors affecting TGA results instrumental and experimental, Applications.

**(B) THERMOMETRIC TITRATION:**

Thermometric Titration (TT), Advantages, Instrument, Applications of TT in Neutralization Titration, Precipitation Titration, Complexometry Titration and Redox titration.



### M.Sc. Semester – I (PRACTICALS)

1. Mixture analysis: (Minimum eight mixtures) Ternary mixture to be given. (S+S+S), Semisolids or ( L+L+L ). Type determination. Separation by physical and chemical methods. (both permitted in case of liquids)
2. Paper Chromatography

#### Reference book:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. A handbook of quantitative and qualitative analysis – H. T. Clarke
4. Comprehensive Practical Organic Chemistry: Qualitative Analysis V K Ahluwalia & S. Dhingra.
5. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
6. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.

